

joint. As clinical experience is gained and technical improvements are made, the technique should also become important in the initial assessment of synovial inflammatory disorders.

In the spine, MRI offers accuracy comparable to that of CT and myelography in the diagnosis of intervertebral disc herniation and is more sensitive to early disc degeneration. In addition, the method can assist in the early diagnosis and characterization of disc space infections and may be beneficial in the follow-up of patients who have undergone a spinal operation or chemonucleolysis.

Patients with total joint replacements and other orthopedic hardware can be safely evaluated by MRI, and image degradation by artifacts is less of a problem than with CT. The technique has also been successfully applied to diverse orthopedic conditions, including the carpal tunnel syndrome, Legg-Calvé-Perthes disease, rotator cuff tear and other glenohumeral joint disorders, stress fractures and pedal neuromas. The potential of MRI as applied to orthopedic disease is yet to be fully explored, and spectroscopy of phosphorus 31 as well as other nuclei may yield valuable insight into the physiologic aspects of such disorders in the future.

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Meniscal Repair

A SYMPTOMATIC meniscal tear, especially in the young, is a serious injury with potentially grave consequences for the knee because the menisci enhance joint stability and reduce the compressive forces sustained per unit area of articular cartilage.

The therapeutic approach to meniscal tears depends on the tear type, location, associated ligamentous injuries and the age and activity of the patient. Treatment options include meniscectomy, partial meniscectomy and meniscal repair. Total meniscectomy is rarely necessary and is not to be undertaken lightly as degenerative arthritis may result. Arthroscopic partial meniscectomy spares portions of the meniscus, allowing for partial fulfillment of its weight-bearing and joint stabilization roles. Although degenerative changes are less likely to develop, joint mechanics are still altered. Meniscal repair, if feasible, preserves normal knee mechanics and logically should provide superior long-term results.

Certain meniscal tears should and do heal. The outer (peripheral) 25% of the meniscus has been shown to be vascular, and healing originates from the peripheral synovial tissues. Meniscal repair can be achieved by open (arthrotomy) and closed (arthroscopy) methods. The arthroscopic method affords greater access to the posterior horn of the lateral meniscus, tears slightly within the meniscocapsular junction and tears deep to the collateral ligaments.

Arthroscopic meniscal repair involves four steps: selecting appropriate tears, preparing the tear margins and adjacent synovium, suturing the tear and rehabilitating postoperatively. Meniscal tears amenable to repair are longitudinal tears more than 1.5 cm within the vascular zone, without serious secondary tears and with demonstrable hyper-

mobility. In addition, ligamentous stability is required. In our experience, 15% of all meniscal tears are repairable.

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Sports Footwear

SIGNIFICANT ADVANCES have occurred in the design and manufacture of sports footwear. The use of impact-absorbing synthetic plastics such as polyurethane and ethylene vinyl acetate has resulted in lighter weight shoes that are resilient and durable yet flexible.

Scientific studies of the mechanisms of sports injuries have found an association with footwear in certain instances. In football, severe knee and ankle injuries can be caused by unyielding foot fixation. This had led to the widespread use of soccer style shoes with molded rubber cleats that develop less torque at the shoe-surface interface than traditional shoes.

Knowledge of the foot and ankle stresses sustained in different activities has stimulated the production of "sports specific" shoes. Shoes specifically designed for running, aerobics and court sports are not interchangeable. For example, running shoes provide hindfoot cushioning and stabilization to withstand loads of as much as three times body weight at heel strike. This is achieved by a thickened sole, a flared heel and a firm, snugly fitting counter. Significant plantar flexion has been shown to decrease cyclic loading of the Achilles tendon.

Court shoes used for tennis and racquetball must accommodate pivoting and lateral movements. Low-profile rubber soles provide increased traction but do not afford the same shock-absorbing capacity as running shoes. In addition, minimal heel elevation that facilitates quick and explosive movements does not relax the Achilles tendon.

The most important criteria in shoe selection are fit and comfort. The longest toe should clear the end of the toe box by half an inch. Leather uppers are generally more expensive but conform best to the shape of the foot over time, thus increasing comfort.

With the exception of barefooted placekickers and occasional runners, the effect of recent developments in footwear has been to maximize performance while decreasing the risk of injury.

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Osseous and Osteochondral Allografts

BONE AND CARTILAGE allografts have proved to be feasible and practical alternatives for reconstructing arthritic joints, obliterating bone defects following trauma or bone dissolution due to various causes and replacing large segments of bone destroyed by bone tumors. The use of allografts to replace large bone defects in revisions for failed total hip replacement has been successful. The allograft bridges the bone defect and provides a scaffold for the ingrowth of vascularized connective tissue that carries the elements necessary for new bone

production. The latter occurs by resorption and replacement of dead trabeculae and appositional growth around dead trabeculae.

Although there is an immune response to transplanted allograft bone, immunosuppressive drugs are not used to neutralize the reaction because of their serious side effects. Graft immunogenicity may be reduced by freezing the allograft before transplantation and forcefully lavaging the allograft bone to remove the fat cells and hematopoietic elements that provoke an immune response in a patient.

Treatment of cartilage allografts with dimethyl sulfoxide and 10% glycerine before freezing has been reported to maintain viability of about 50% of donor chondrocytes. There is a question, however, as to the capacity of these cells to produce collagen and mucopolysaccharides after thawing and transplantation.

More recently there have been reports of the successful resurfacing of portions of synovial joints in the lower extremities with fresh nonfrozen composite graft of hyaline cartilage and bone. The bone portion provokes a clinically insignificant immune response. The cartilage of the graft is thought to be "immunologically privileged" because the matrix prevents the diffusion of large molecules of antigens and antibodies. Because of this, the afferent and efferent arms of the immune reaction cannot interact and produce a rejection response.

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Endoprosthetic Limb Salvage Operation for Malignant Bone Tumors

THE HISTORICAL APPROACH to the local control of primary malignant bone tumors, including osteosarcoma, chondrosarcoma, fibrosarcoma, malignant fibrohistiocytoma and, in certain instances, Ewing's sarcoma, has been amputation. Recent advances in surgical resection techniques, muscle transfers and improved mechanical design of custom endo-

protheses have established the limb-sparing operation as a possible alternative for local control of malignant bone tumors when coupled with preoperative adjuvant therapy.

Two basic goals must be achieved by a limb-sparing operation for malignant bone tumors. The local recurrence rate in a salvaged extremity should be no higher than that achieved with amputation, and the reconstructed extremity should be enduring and functional, without requiring repetitive hospital admissions for the management of local complications or complex revisional procedures.

The functional results of endoprosthetic reconstruction following wide resection for malignant bone tumors have been excellent about the knee and good to excellent at the hip. Scapular and proximal humeral replacements permit normal hand and elbow function and avoid the need for orthoses and cumbersome prostheses. For pelvic lesions, an internal hemipelviectomy, when feasible, retains the extremity and results in an extremity with good cosmetic appearance and moderate function. Neurovascular gastrocnemius muscle transfers permit endoprosthetic replacement of the proximal tibia with the anticipation of reasonable extensor function of the knee. Expandable prostheses make limb salvage for a very young patient, especially with Ewing's sarcoma, feasible.

Preoperative chemotherapy and radiation therapy have decreased the local recurrence rate after a limb-sparing operation to 5%, not statistically different from the local recurrence rates seen following amputation. In the absence of preoperative adjuvant chemotherapy, the reported local recurrence rates range between 20% and 60%.

In summary, limb-sparing surgical techniques using improved custom endoprostheses with preoperative adjuvant chemotherapy now permit a limb-sparing operation in most patients presenting with primary malignant bone tumors. Amputation for the primary control of malignant bone tumors continues to be indicated for those patients who present with very large tumors, those with incorrectly placed or infected biopsy incisions and patients who present with tumors of the distal tibia or the foot.

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